Proposed Resource Management Plan and
Final Environmental Impact Statement

Bighorn Basin Resource Management Plan Revision Project

Appendix L

Required Design Features and Best Management Practices

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APPENDIX L

REQUIRED DESIGN FEATURES AND BEST MANAGEMENT PRACTICES

Required Design Features (RDFs) are required for certain activities in greater sage-grouse habitat. RDFs establish the minimum specifications for certain activities to help mitigate adverse impacts. However, the applicability and overall effectiveness of each RDF cannot be fully assessed until the project level when the project location and design are known. Because of site-specific circumstances, some RDFs may not apply to some projects (e.g., a resource is not present on a given site) and/or may require slight variations (e.g., a larger or smaller protective area). All variations in RDFs would require that at least one of the following be demonstrated in the National Environmental Policy Act (NEPA) analysis associated with the project/activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g., due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable;
- An alternative RDF is determined to provide equal or better protection for greater sage-grouse or its habitat; or
- A specific RDF will provide no additional protection to greater sage-grouse or its habitat.

Adverse environmental impacts associated with development can be avoided, reduced, or mitigated through the project's design and implementation. In order to provide regulatory certainty that the measures will be incorporated, they must be required of every project. The National Technical Team (NTT) report identified management actions and practices that would reduce adverse impacts to greater sage-grouse if mandated to development throughout Core Area (Priority Habitat Management Areas). Some of these practices are incorporated in Alternative D as being universally appropriate. The ones that could be analyzed on a planning area-wide basis have been made a part of the management actions and in this appendix as RDFs.

Other environmental protection measures could not be analyzed in a resource area-wide Environmental Impact Statement (EIS) because their appropriateness depends upon site-specific issues such as proximity to the boundary of Priority Habitat Management Areas or non-crucial habitat or engineering or physical limitations such as an oil and gas producing zone being too close to the surface to be recoverable through directional drilling. These best management practices (BMPs) are required to be considered in a site-specific project's design to reduce, prevent, or avoid adverse environmental or social impacts. These practices are analyzed to help ensure that development is conducted in an environmentally responsible manner. Some BMPs are as simple as choosing a paint color that helps oil and natural gas equipment blend with the natural surroundings, making development less visible. Other BMPs may reduce the amount of vegetation lost to development, improve the speed of re-growth of desirable vegetation, or may reduce the amount of wildlife disturbance in important habitats. Public land users are encouraged to review these practices, incorporate them where appropriate, or develop better methods for achieving the same goal. However, the Bureau of Land Management (BLM) may also require their incorporation into the design features of the project as a Condition of Approval (COA). A design feature should only be considered as a potential beneficial impact under the NEPA when it is part of a BLM authorization as a COA. If the practice is only voluntary or suggested, the BLM lacks the authority to require its implementation, so the project should be analyzed as if the practice will not

occur. The BLM authorization will make clear whether the BMP is mandatory (attached as a COA) or merely encouraged.

NEPA analysis that concludes that BMPs should not be attached as mandatory COAs needs to clearly explain why with relation to site-specific factors. The purpose of this section is not to select certain practices or designs and require that only those be used. It is not possible to evaluate all the known practices and make determinations as to which are best, particularly without a specific project in a specific location. BMPs should be matched and adapted to meet the site-specific requirements of the management action, project and local environment. No one management practice is best suited to every site or situation, or will remain the most optimal practice over time. BMPs must be adaptive and monitored regularly to evaluate effectiveness. As discussed more fully in the Special Status Species-Wildlife section, protections for the greater sage-grouse are an important focal point in the preparation of the Resource Management Plan (RMP). Accordingly, a special section of BMPs identifies management that should be considered in greater sage-grouse priority habitat. It is expected that these BMPs will change over time as monitoring and further study develop improved greater sage-grouse protections.

1.0 REQUIRED DESIGN FEATURES

The following design approaches are required for all projects unless the proponent establishes that due to site limitations or engineering considerations, the design approaches are infeasible. Economic considerations such as increased costs do not render a design infeasible. The following measures would be applied as RDFs for all solid minerals. They would also apply to locatable minerals subject to valid existing rights and consistent with applicable law.

1.1 Greater Sage-Grouse Protection Required Design Features for All Projects

The following measures, and others as they are identified, will be required for all BLM-authorized development. As appropriate, they may be required as part of the design of the project or as a mandatory COA. The following required design features are found in the Sage-Grouse National Technical Team report (Sage-grouse NTT 2011) titled "A Report on National Greater Sage-Grouse Conservation Measures".

General

1. Evaluate and take advantage of opportunities to remove or modify existing power lines within priority sage-grouse habitat areas. When possible, require perch deterrents on existing or new overhead facilities. Encourage installation of perch deterrents on existing facilities.
2. Where existing leases or rights-of-way (ROWs) have had some level of development (road, fence, well, etc.) and are no longer in use, reclaim the site by removing these features and restoring the habitat.
3. Locate man camps outside priority sage-grouse habitats.
4. Work cooperatively with permittees, leasees, and other landowners to develop grazing management strategies that integrate both public and private lands into single management units.

5. Coordinate BMPs and vegetative objectives with the Natural Resources Conservation Service (NRCS) for consistent application across jurisdictions where the BLM and NRCS have the greatest opportunities to benefit greater sage-grouse, particularly as it applies to the NRCS's National Sage-Grouse Initiative: (http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/farmbill/initiatives/and cid=steldevb1027671).
6. When conducting NEPA analysis for water developments or other rangeland improvements address the direct and indirect effects to sage-grouse populations and habitat.
7. Evaluate the role of existing seedings that are currently composed of primarily introduced perennial grasses in and adjacent to priority sage-grouse habitats to determine if they should be restored to sagebrush or habitat of higher quality for sage-grouse. If these seedings are part of an Allotment Management Plan/Conservation Plan or if they provide value in conserving or enhancing the rest of the priority habitats, then no restoration would be necessary. Assess the compatibility of these seedings for sage-grouse habitat or as a component of a grazing system during land health assessments. For example, some introduced grass seedings are an integral part of a livestock management plan and reduce grazing pressure in important sagebrush habitats, or serve as a strategic fuels management area.
8. Where the federal government owns the surface, and the mineral estate is in non-federal ownership, apply appropriate BMPs to surface development.

Roads

1. Design roads to an appropriate standard no higher than necessary to accommodate their intended purpose.
2. Locate roads to avoid important areas and habitats.
3. Coordinate road construction and use among Federal fluid mineral lessees and ROW or Surface Use Agreement (SUA) holders.
4. Construct road crossings of ephemeral, intermittent, and perennial streams to minimize impacts to the riparian habitat, such as by crossing at right angles to ephemeral drainages and stream crossings.
5. Establish slow speed limits on BLM and Forest Service system-administered roads or design roads for slower vehicle speeds to reduce sage-grouse mortality.
6. Establish trip restrictions or minimization through use of telemetry and remote well control (e.g., Supervisory Control and Data Acquisition).
7. Do not issue ROWs or SUAs to counties on energy development roads, unless for a temporary use consistent with all other terms and conditions including this document.
8. Restrict vehicle traffic to only authorized users on newly constructed routes (using signage, gates, etc.)
9. Apply dust abatement on roads, well pads, and other surface disturbances.
10. Close and rehabilitate duplicate roads by restoring original landform and establishing a desirable plant community.
11. Do not issue ROWs to counties on newly constructed energy development roads, unless for a temporary use consistent with all other terms and conditions included in this document.

Operations

1. Site and/or minimize linear ROWs or SUAs to reduce disturbance and fragmentation of sagebrush habitats.
2. Place new utility developments (power lines, pipelines, etc.) and transportation routes in existing utility or transportation corridors.
3. Bury power lines to the extent technically feasible.
4. Collocate powerlines, flowlines, and small pipelines under or immediately adjacent to existing roads/transportation corridors.
5. Cover all fluid-containing pits and open tanks with netting (maximum 1.5-inch mesh size) regardless of size to reduce sage-grouse mortality.
6. Equip tanks and other above ground facilities with structures or devices that discourage nesting and perching of raptors and corvids.
7. Control the spread and effects of invasive non-native plant species, including treating weeds prior to surface disturbance and washing vehicles and equipment at designated wash stations when constructing in areas with weed infestations.
8. Require sage-grouse-safe fences.
9. Clean up refuse.
10. Locate mining camps outside of priority sage-grouse habitats.
11. Fit transmission towers with anti-perch devices.
12. Construct sage-grouse-safe fences around sumps.
13. Cluster disturbances, operations (hydraulic fracture stimulation, liquids gathering, etc.), and facilities.
14. Use directional and horizontal drilling to the extent feasible as a means to reduce surface disturbance in relation to the number of wells.
15. Place infrastructure in already disturbed locations where the habitat has not been fully restored.
16. Apply a phased development approach with concurrent reclamation.
17. Place liquid gathering facilities outside priority areas. To reduce truck traffic and perching and nesting sites for ravens and raptors do not place tanks at well locations within priority habitat areas.
18. Pipelines must be under or immediately adjacent to the road.
19. Use remote monitoring techniques for production facilities and develop a plan to reduce the frequency of vehicle use.
20. Restrict the construction of tall facilities, distribution powerlines, and fences to the minimum number and amount needed.
21. Design or site permanent structures to minimize impacts to sage-grouse, with emphasis on locating and operating facilities that create movement (e.g., pump jacks) or attract frequent human use and vehicular traffic (e.g., fluid storage tanks) in a manner that will minimize disturbance of sage-grouse or interference with habitat use.

22. Use only closed-loop systems for drilling operations, with no reserve pits.
23. Consider using oak (or other material) mats for drilling activities where topography permits to reduce vegetation disturbance and for temporary roads between closely-spaced wells to reduce soil compaction and maintain soil structure to increase likelihood of vegetation reestablishment following drilling.

West Nile

1. Restrict impoundment construction to reduce or eliminate threats from West Nile Virus (WNv).
2. Increase the size of freshwater ponds to accommodate a greater volume of water than is discharged. This will result in un-vegetated and muddy shorelines that breeding *Cx. tarsalis* avoid. This modification may reduce *Cx. tarsalis* habitat but could create larval habitat for *Culicoides sonorensis*, a vector of blue tongue disease, and should be used sparingly. Steep shorelines should be used in combination with this technique whenever possible.
3. Build steep shorelines to reduce shallow water (greater than 60 centimeters [cm]) and aquatic vegetation around the perimeter of impoundments. Construction of steep shorelines also will create more permanent ponds that are a deterrent to colonizing mosquito species like *Cx. tarsalis* which prefer newly flooded sites with high primary productivity.
4. Maintain water levels below that of rooted vegetation for a muddy shoreline that is unfavorable habitat for mosquito larvae. Rooted vegetation includes both aquatic and upland vegetative types. Avoid flooding terrestrial vegetation in flat terrain or low lying areas. Aquatic habitats with a vegetated inflow and outflow separated by open water produce 5 to 10 fold fewer *Culex* mosquitoes than completely vegetated wetlands. Wetlands with open water also had significantly fewer stage III and IV instars which may be attributed to increased predator abundances in open water habitats.
5. Construct dams or impoundments that restrict down slope seepage or overflow by digging ponds in flat areas rather than damming natural draws for effluent water storage, or lining constructed ponds in areas where seepage is anticipated.
6. Line channels where discharge water flows into ponds with crushed rock, or use a horizontal pipe to discharge inflow directly into existing open water, thus precluding shallow surface inflow and accumulation of sediment that promotes aquatic vegetation.
7. Line the overflow spillway with crushed rock, and construct the spillway with steep sides to preclude the accumulation of shallow water and vegetation.
8. Fence pond sites to restrict access by livestock and other wild ungulates that trample and disturb shorelines, enrich sediments with manure and create hoof print pockets of water that are attractive to breeding mosquitoes.
9. Manage artificial water impoundments for the prevention and/or spread of WNv where the virus poses a threat to sage-grouse. This may include but is not limited to: (a) the use of larvicides and adulticides to treat waterbodies; (b) overbuilding ponds to create non-vegetated, muddy shorelines; (c) building steep shorelines to reduce shallow water and emergent aquatic vegetation; (d) maintaining the water level below rooted vegetation; (e) avoiding flooding terrestrial vegetation in flat terrain or low lying areas; (f) constructing dams or impoundments that restrict seepage or overflow; (g) lining the channel where discharge water flows into the pond with crushed rock, or use a horizontal pipe to discharge inflow directly into existing open water; (h) lining the overflow spillway with crushed rock and construct the spillway with steep

sides to preclude the accumulation of shallow water and vegetation; and (i) restricting access of ponds to livestock and wildlife.

10. Field Offices should consider alternate means to manage produced waters that could present additional vectors for WNv. Such remedies may include re-injection under an approved Underground Injection Control permit, transfer to single/centralized facility, etc.
11. Policy Statement 7 regarding WNv does not apply to naturally occurring waters.
12. Design impoundments for wildlife and/or livestock use to reduce the potential to produce vectors for WNv where the virus may pose a threat to sage-grouse.
13. Manage water impoundments to prevent the spread of WNv where analysis shows the virus poses a threat to sage-grouse and may result in negative impacts to other species of concern.
14. Remove or re-inject produced water to reduce habitat for mosquitoes that vector WNv. If surface disposal of produced water continues, use the following steps for reservoir design to limit favorable mosquito habitat:
    - Overbuild size of ponds for muddy and non-vegetated shorelines.
    - Build steep shorelines to decrease vegetation and increase wave actions.
    - Avoid flooding terrestrial vegetation in flat terrain or low lying areas.
    - Construct dams or impoundments that restrict down slope seepage or overflow.
    - Line the channel where discharge water flows into the pond with crushed rock.
    - Construct spillway with steep sides and line it with crushed rock.
15. Treat waters with larvicides to reduce mosquito production where water occurs on the surface.
16. Restrict pit and impoundment construction to reduce or eliminate threats from WNv.

Noise

1. Limit noise to less than 10 decibels above ambient measures (20 to 24 decibels) at sunrise at the perimeter of a lek during active lek season.
2. Require noise shields when drilling during the lek, nesting, brood-rearing, or wintering season.
3. Locate new compressor stations outside priority habitats and design them to reduce noise that may be directed towards priority habitat.
4. Require sage-grouse safe fences.

Reclamation

1. Include objectives for ensuring habitat restoration to meet sage-grouse habitat needs in reclamation practices/sites. Address post reclamation management in reclamation plan such that goals and objectives are to protect and improve sage-grouse habitat needs.
2. Maximize the area of interim reclamation on long-term access roads and well pads, including reshaping, topsoiling, and revegetating cut-and-fill slopes.
3. Restore disturbed areas at final reclamation to the pre-disturbance landforms and desired plant community.

4. Implement irrigation during interim or final reclamation for sites where establishment of seedlings has been shown or is expected to be difficult due to dry conditions. Utilize mulching techniques to expedite reclamation.
5. Use mulching, soil amendments, and/or erosion blankets to expedite reclamation and to protect soils.
6. Address post reclamation management in reclamation plan such that goals and objectives are to protect and improve sage-grouse habitat needs.
7. Minimize surface-disturbing or disrupting activities (including operations and maintenance) where needed to reduce the impacts of human activities on important seasonal sage-grouse habitats. Apply these measures during project level planning.
8. When conducting NEPA analysis for wild horse and burro management activities, water developments or other rangeland improvements for wild horses in priority sage-grouse habitat, address (and apply conservation measures as appropriate) the direct and indirect effects to sage-grouse populations and habitat.
9. During activity level planning, where appropriate, designate routes with current administrative/agency purpose or need to administrative access only.
10. Identify and work with partners to increase native seed availability and work with plant material centers to develop new plant materials, especially the forbs needed to restore sage-grouse habitat.
11. Consider potential changes in climate when proposing seedings using native plants. Consider seed collections from the warmer component within a species' current range for selection of native seed.
12. Use Ecological Site Descriptions (ESDs) or other protocols could be used (e.g., TEUI or LSI) to identify the understory species and sagebrush subspecies needed to restore desirable habitat conditions.

Vegetation Treatments/Fire and Fuels Management

1. During vegetation management project design, consider the utility of using livestock to strategically reduce fine fuels, and implement grazing management that will accomplish this objective. Consult with ecologists to minimize impacts to native perennial grasses.
2. Provide to personnel planning vegetation treatments information on sage-grouse biology, habitat requirements, and identification of areas utilized locally.
3. Use vegetation treatment prescriptions that minimize undesirable effects on vegetation or soils (e.g., minimize mortality of desirable plant species and reduce risk of hydrophobicity.
4. Ensure proposed sagebrush treatments are planned with interdisciplinary input from BLM/Forest Service and /or state wildlife agency biologist and that treatment acreage is conservative in the context of surrounding sage-grouse seasonal habitats and landscape.
5. Ensure that treatments are configured in a manner (e.g., strips) that promotes use by sage-grouse.
6. Where appropriate, incorporate roads and natural fuels breaks into fuels break design.
7. Power-wash all vehicles and equipment involved in vegetation treatment activities prior to entering the area to minimize the introduction of undesirable and/or invasive plant species.

8. Design vegetation treatments in areas of high wildfire frequency to facilitate firefighter and public safety, reduce the risk of extreme fire behavior; and to reduce the risk and rate of fire spread to sage-grouse habitats.
9. Restore prior perennial grass/shrub plant communities infested with non-native invasive species to a species composition characterized by perennial grasses, forbs, and shrubs as outlined in ESDs.
10. Emphasize the use of native plant species, recognizing that non-native species may be necessary depending on the availability of native seed and prevailing site conditions.
11. Reduce the risk of vehicle or human-caused wildfires and the spread of invasive species into sage-grouse habitats could be minimized by planting perennial vegetation (e.g., green-strips) paralleling road ROWs (this BMP could be applied to BLM linear ROW authorizations).
12. Strategically place and maintain pre-treated strips/areas (e.g., mowing, herbicide application, and strictly managed grazed strips) to aid in controlling wildfire should wildfire occur near sage-grouse key habitats or important restoration areas (such as where investments in restoration have already been made).
13. Design vegetation treatments in sage-grouse habitats to strategically reduce wildfire threats in the greatest area. This may involve spatially arranging new vegetation treatments with past treatments, vegetation with fire-resistant serial stages, natural barriers, and roads in order to constrain fire spread and growth. This may require vegetation treatments to be implemented in a more linear versus block design.
14. Design post Emergency Stabilization and Rehabilitation (ES&R) and Burned Area Emergency Response management to ensure long term persistence of seeded or pre-burn native plants. This may require temporary or long-term changes in livestock grazing, wild horse and burro, and travel management, etc., to achieve and maintain the desired condition of ES&R and Burned Area Emergency Response projects to benefit sage-grouse. Include sage-grouse habitat parameters as defined by Connelly et al., Hagen et al., or if available, State Sage-Grouse Conservation plans and appropriate local information in habitat restoration objectives. Make maintaining these objectives within priority sage-grouse habitat areas a high restoration priority.
15. Make re-establishment of sagebrush and desirable understory plant cover (relative to ecological site potential) a high priority for restoration efforts. Write specific vegetation objectives to reestablish sage-brush cover and desirable understory cover.
16. Where applicable, design fuels treatment objective to protect existing sagebrush ecosystems, modify fire behavior, restore native plants, and create landscape patters which most benefit sage-grouse habitat.
17. Provide training to fuels treatment personnel on sage-grouse biology, habitat requirements, and identification of areas utilized locally.
18. Use fire prescriptions that minimize undesirable effects on vegetation or soils (e.g., minimize mortality of desirable perennial plant species and reduce risk of hydrophobicity).
19. Ensure proposed sagebrush treatments are planned with interdisciplinary input from BLM, Forest Service and/or state wildlife agency biologist and that treatment acreage is conservative in the context of surrounding sage-grouse seasonal habitats and landscape.

20. Where appropriate, ensure that treatments are configured in a manner (e.g., strips) that promotes use by sage-grouse.
21. Where applicable, incorporate roads and natural fuel breaks into fuel break design.
22. Power-wash all firefighting vehicles, including engines, water tenders, personnel vehicles, and all-terrain vehicles (ATVs) prior to deploying in or near sage-grouse habitat areas to minimize noxious weed spread.
23. Design vegetation treatment in areas of high frequency to facilitate firefighting safety, reduce the risk of extreme fire behavior; and to reduce the risk and rate of fire spread to sage-grouse key habitats and restoration habitats.
24. Give priority for implementing specific sage-grouse habitat restoration projects in areas infested with undesirable annual grasses first to sites which are adjacent to or surrounded by sage-grouse key habitats. Areas infested with undesirable annual grasses are second priority for restoration when the sites not adjacent to key habitat, but within two miles of key habitat. The third priority for areas infested with undesirable annual grasses habitat restoration projects are sites beyond two miles of key habitat. The intent is to focus restoration outward from existing, intact habitat.
25. As funding and logistics permit, restore areas infested with undesirable annual grasses to a species composition characterized by perennial grasses, forbs, and shrubs.
26. Emphasize the use of native plant species, recognizing that non-native species may be necessary depending on the availability of native seed and prevailing site conditions.
27. Remove standing and encroaching trees within at least 100 meters of occupied sage-grouse leks and other habitats (e.g., nesting, wintering, and brood rearing) to reduce the availability of perch sites for avian predators, as appropriate, and resources permit.
28. Protect wildland areas from wildfire originating on private lands, infrastructure corridors, and recreational areas.
29. Develop state-specific sage-grouse reference information and resource materials containing maps, a list of resource advisors, contact information, local guidance, and other relevant information.
30. Provide localized maps to dispatch offices and extended attack incident commanders for use in prioritizing wildfire suppression resources and designing suppression tactics.
31. Assign a sage-grouse resource advisor to all extended attack fires in or near priority sage-grouse habitat areas. Prior to the fire season, provide training to sage-grouse resource advisors on wildfire suppression organization, objectives, tactics, and procedures to develop a cadre of qualified individuals.
32. On critical fire weather days, pre-position additional fire suppression resources to optimize a quick and efficient response in sage-grouse habitat areas.
33. During periods of multiple fires, ensure line officers are involved in setting priorities.
34. Locate wildfire suppression facilities (i.e., base camps, spike camps, drop points, staging areas, and heli-bases) in areas where physical disturbance to sage-grouse habitat can be minimized. These include disturbed areas, grasslands, near roads/trails or in other areas where there is existing disturbance or minimal sagebrush cover.

35. Minimize unnecessary cross-country vehicle travel during fire operations in sage-grouse habitat.
36. Minimize burnout operations in key sage-grouse habitats by constructing direct firelines whenever safe and practical to do so.
37. Utilize retardant and mechanized equipment to minimize burned acreage during initial attack.
38. As safety allows, conduct mop-up where the black adjoins unburned islands, dog legs, or other habitat features to minimize sagebrush loss.

Fire Operations Best Management Practices for Sage-Grouse Conservation

1. Compile district-level information into state-wide sage-grouse tool boxes. Tool boxes will contain maps, listing of resource advisors, contact information, local guidance, and other relevant information for each district, which will be aggregated into a state-wide document.
2. Provide localized maps to dispatch offices and extended attack incident commanders for use in prioritizing wildfire suppression resources and designing suppression tactics.
3. Assign a resource advisor with sage-grouse expertise, or who has access to sage-grouse expertise, to all extended attack fires in or near sage-grouse habitat areas. Prior to the fire season, provide training to sage-grouse resource advisors on wildfire suppression organization, objectives, tactics, and procedures to develop a cadre of qualified individuals.
4. On critical fire weather days, pre-position additional fire suppression resources to optimize a quick and efficient response in sage-grouse habitat areas.
5. As appropriate, utilize existing fuel breaks, such as roads or discrete changes in fuel type, as control lines in order to minimize fire spread.
6. During periods of multiple fires, ensure line officers are involved in setting priorities.
7. To the extent possible, locate wildfire suppression facilities (i.e., base camps, spike camps, drop points, staging areas, heli-bases, etc.) in areas where physical disturbance to sage-grouse habitat can be minimized. These include disturbed areas, grasslands, near roads/trails or in other areas where there is existing disturbance or minimal sagebrush cover.
8. Power-wash all firefighting vehicles, to the extent possible, including engines, water tenders, personnel vehicles, and ATVs prior to deploying in or near sage-grouse habitat areas to minimize noxious weed spread.
9. Minimize unnecessary cross-country vehicle travel during fire operations in sage-grouse habitat.
10. Minimize burnout operations in key sage-grouse habitat areas by constructing direct fireline whenever safe and practical to do so.
11. Utilize retardant, mechanized equipment, and other available resources to minimize burned acreage during initial attack.
12. As safety allows, conduct mop-up where the black adjoins unburned islands, dog legs, or other habitat features to minimize sagebrush loss.
13. Adequately document fire operation activities in sage-grouse habitat for potential follow-up coordination activities.

Fuels Management Best Management Practices for Sage-Grouse Conservation

1. Where applicable, design fuels treatment objectives to protect existing sagebrush ecosystems, modify fire behavior, restore native plants, and create landscape patterns which most benefit sage-grouse habitat.
2. Provide training to fuels treatment personnel on sage-grouse biology, habitat requirements, and identification of areas utilized locally.
3. Use burning prescriptions which minimize undesirable effects on vegetation or soils (e.g., minimize mortality of desirable perennial plant species and reduce risk of annual grass invasion).
4. Ensure proposed sagebrush treatments are planned with full interdisciplinary input pursuant to NEPA and coordination with state fish and wildlife agencies, and that treatment acreage is conservative in the context of surrounding sage-grouse seasonal habitats and landscape.
5. Where appropriate, ensure that treatments are configured in a manner that promotes use by sage-grouse.
6. Where applicable, incorporate roads and natural fuel breaks into fuel break design.
7. Power-wash all vehicles and equipment involved in fuels management activities, prior to entering the area, to minimize the introduction of undesirable and/or invasive plant species.
8. Design vegetation treatments in areas of high fire frequency which facilitate firefighter safety, reduce the potential acres burned, and reduce the fire risk to sage-grouse habitat. Additionally, develop maps for sage-grouse habitat which spatially display current fuels treatment opportunities for suppression resources.
9. Give priority for implementing specific sage-grouse habitat restoration projects in areas infested with undesirable annual grasses, first to sites which are adjacent to or surrounded by preliminary priority habitat (PPH) or that reestablish continuity between priority habitats. Areas infested with undesirable annual grasses are a second priority for restoration when the sites are not adjacent to PPH, but within two miles of PPH. The third priority for areas infested with undesirable annual grasses habitat restoration projects are sites beyond two miles of PPH. The intent is to focus restoration outward from existing, intact habitat.
10. As funding and logistics permit, restore areas infested with undesirable annual grasses to a species composition characterized by perennial grasses, forbs, and shrubs or one of that referenced in land use planning documentation.
11. Emphasize the use of native plant species, recognizing that non-native species may be necessary depending on the availability of native seed and prevailing site conditions.
12. Remove standing and encroaching trees within at least 100 meters of occupied sage-grouse leks and other habitats (e.g., nesting, wintering and brood rearing) to reduce the availability of perch sites for avian predators, as resources permit.
13. Protect wildland areas from wildfire originating on private lands, infrastructure corridors, and recreational areas.

Oil and Gas Development

1. Require unitization when deemed necessary for proper development and operation of an area or to facilitate more orderly (e.g., phased and/or clustered) development as a means of minimizing adverse impacts to resources, including greater sage-grouse, so long as the unitization plan adequately protects the rights of all parties including the United States, according to the Federal Lease Form, 3100-11, Sections 4 and 6.

2.0 BEST MANAGEMENT PRACTICES

The best management practices (BMPs) shown in this appendix are not intended to encompass all potentially applicable BMPs. Instead, Appendix L was developed to address specific issues brought forward during scoping, alternative development, and comments from the public and cooperating agencies.

2.1 Best Management Practices for Important Cultural Resource and Trail Settings

The BLM should use standard measures to reduce the visual impact of proposed actions within trail settings, where setting is a contributing element of eligibility to the National Register of Historic Places and the setting has integrity. Standard measures should be used as stipulations or conditions of approval attached to authorizations. Standard measures, or BMPs, for reducing the visibility of proposed actions include, but are not limited to:

- Apply a controlled surface use (CSU) stipulation to surface-disturbing activities or surface occupancy.
- Visual Contrast Ratings and, as appropriate, require visual simulations.
- Consolidate project facilities among oil and gas developers; maximize use of existing locations.
- Develop coordinated road and pipeline systems.
- Reduce the amount of surface development by consolidating facilities.
- Use low profile facilities.
- Locate projects to maximize the use of topography and vegetation to screen development.
- Design projects to blend with topographic forms and existing vegetation patterns.
- Use environmental coloration or camouflage techniques to reduce the visual impact of facilities that cannot be completely hidden.
- Use broken linear patterns for road developments to screen roads as much as possible. This can include feathering or blending of the edges of linear rights-of-way to soften the dominant line form.
- For livestock control, use electric fencing with low-visibility fiberglass posts and environmental colors.
- Design linear facilities and seismic lines to run parallel to key observation points rather than perpendicular.
- Position facilities to present less of a visual impact (e.g., a facility with several tanks lined up so that one obscures the visibility of the others).

2.2 Decontamination Procedure for Aquatic Invasive Species

To prevent the spread of aquatic invasive species, the Wyoming Game and Fish Department recommends following the guidelines outlined in the *Aquatic Invasive Species in Wyoming* brochure (link below). Specific BMPs to aquatic invasive species spread prevention include, but are not limited to:

- Decontamination should first occur before arrival at a project site, so aquatic invasive species are not transferred from the last visited area. Decontamination should occur again before leaving a project site, so aquatic invasive species are not transferred to the next site.
- Decontamination may consist of either:

    1. Drain all water from equipment and compartments, clean equipment of all mud, plants, debris, or animals, and dry equipment for five days in summer (June, July, and August); 18 days in spring (March, April, and May) and fall (September, October, and November); or three days in winter (December, January, and February) when temperatures are at or below freezing,

    -or-

    2. Use a high pressure (2,500 pounds per square inch [psi]) hot water (140°F) pressure washer to thoroughly wash equipment and flush all compartments that may hold water.

http://gf.state.wy.us/fish/AIS/index.asp

2.3 Wyoming Forestry Best Management Practices

The Wyoming Forestry Best Management Practices: Forestry BMPs Water Quality Protection Guidelines (link below) describes BMPs for the management of forest lands. These BMPs are a set of voluntary preferred methods of forestland management designed to protect water quality and forest soils, and are intended for use on non-industrial private, forest industry, state-owned and federal forests.

http://slf-web.state.wy.us/forestry/bmp2.aspx

2.4 Reseeding Best Management Practices

The following recommendations may be required depending on the project size and location.

1. Proposed actions where native brush species located on lands proposed to be disturbed are unique and desirable for interim and final reclamation purposes, and the seed supply for these desirable brush species is not commercially available, will be collected from the area and stored using the procedures of the Seeds of Success program. Seedlings or plugs of common dominant species will be propagated, preferably locally, in preparation for use in portions of area to be reclaimed to expedite vegetation recovery.
2. Areas of sustainable plant communities and populations (where they do not conflict with other allowable resource uses) will be identified as sources for native plant material and will be managed under consideration of the need to consistently produce seed stocks of non-commercially available materials for use in reclamation and restoration work (e.g., to support reclamation of abandoned mine lands or well pads or to supplement commercially available seeds in high fire years).

2.5 Engineering Best Management Practices

Road maintenance, construction, and any other related travel and transportation management will be mandated by BLM Manual 9113. BLM Manual 9113 provides for BMPs to be used in evaluating, maintaining, and constructing BLM travel and transportation routes. As stated in Manual 9113, "Bureau roads must be designed to an appropriate standard no higher than necessary to accommodate their intended functions adequately (timber hauling administrative access, public travel); and design, construction, and maintenance activities must be consistent with national policies for safety, aesthetics, protection and preservation of cultural, historic, and scenic values, and accessibility for the physically handicapped. The following is a list of BMPs that are recommended but not binding for road maintenance practices:

1. Design roads to minimize total disturbance, to conform with topography, and to minimize disruption of natural drainage patterns.
2. Base road design criteria and standards on road management objectives such as traffic requirements of the proposed activity and the overall TP, economic analysis, safety requirements, resource objectives, and minimizing damage to the environment.
3. Locate roads on stable terrain such as ridge tops, natural benches, and flatter transitional slopes near ridges, and valley bottoms, and moderate side slopes and away from slumps, slide prone areas, concave slopes, clay beds, and where rock layers dip parallel to the slope. Locate roads on well-drained soil types; avoid wet areas when possible.
4. Construct cut and fill slopes to be approximately 3 horizontal (h):1 vertical (v) or flatter where feasible. Locate roads to minimize heights of cutbanks. Avoid high, steeply sloping cutbanks in highly fractured bedrock.
5. Avoid headwalls, midslope locations on steep, unstable slopes, fragile soils, seeps, old landslides, side slopes in excess of 70 percent, and areas where the geologic bedding planes or weathering surfaces are inclined with the slope. Implement extra mitigation measures when these areas cannot be avoided.
6. Construct roads for surface drainage by using outslopes, crowns, grade changes, drain dips, waterbars and in-sloping to ditches as appropriate.
7. Sloping the road base to the outside edge for surface drainage is normally recommended for local spurs or minor collector roads where low-volume traffic and lower traffic speeds are anticipated. This is also recommended in situations where long intervals between maintenance will occur and where minimum excavation is wanted. Out-sloping is not recommended on steep slopes. Sloping the road base to the inside edge is an acceptable practice on roads with steep side slopes and where the underlying soil formation is very rocky and not subject to appreciable erosion or failure.
8. Crown and ditching is recommended for arterial and collector roads where traffic volume, speed, intensity and user comfort are considerations. Recommended gradients range from 0 to 15 percent where crown and ditching may be applied, as long as adequate drainage away from the road surface and ditch lines is maintained.
9. Minimize excavation, when constructing roads, through the use of balanced earthwork, narrowing road widths, and end hauling where side slopes are between 50 and 70 percent.

10. If possible, construct roads when soils are dry and not frozen. When soils or road surfaces become saturated to a depth of 3 inches, BLM-authorized activities should be limited or ceased unless otherwise approved by the authorized officer.
11. Consider improving inadequately surfaced roads that are to be left open to public traffic during wet weather with gravel or pavement to minimize sediment production and maximize safety.
12. Retain vegetation on cut slopes unless it poses a safety hazard or restricts maintenance activities. Roadside brushing of vegetation should be done in a way that prevents disturbance to root systems and visual intrusions (i.e., avoid using excavators for brushing).
13. Retain adequate vegetation between roads and streams to filter runoff caused by roads.
14. Avoid riparian/wetland areas where feasible; locate in riparian/wetland areas only if the roads do not interfere with the attainment of resource objectives.
15. Minimize the number of unimproved stream crossings. When a culvert or bridge is not feasible, locate drive-through (low water crossings) on stable rock portions of the drainage channel. Harden crossings with the addition of rock and gravel if necessary. Use angular rock if available.
16. Locate roads and limit activities of mechanized equipment within stream channels to minimize their influence on riparian areas. When crossing a stream is necessary, design the approach and crossing perpendicular to the channel, where practicable. Locate the crossing where the channel is well defined, unobstructed, and straight.
17. Avoid placing fill material in floodplain unless the material is large enough to remain in place during flood events.
18. Use drainage dips instead of culverts on level 2 roads where gradients will not present a safety issue. Locate drainage dips in such a way so that water will not accumulate or where outside berms prevent drainage from the roadway. Locate and design drainage dips immediately upgrade of stream crossings and provide buffer areas and catchment basins to prevent sediment from entering the stream.
19. Construct catchment basins, brush windrows, and culverts in a way to minimize sediment transport from road surfaces to stream channels. Install culverts in natural drainage channels in a way to conform with the natural streambed gradients with outlets that discharge onto rocky or hardened protected areas.
20. Design and locate water crossing structures in natural drainage channels to accommodate adequate fish passage, provide for minimum impacts to water quality, and to be capable of handling a 100-year event for runoff and floodwaters.
21. Use culverts that pass, at a minimum, a 25-year storm event or have a minimum diameter of 24 inches for permanent stream crossings and a minimum diameter of 18 inches for road cross drains.
22. Replace undersized culverts and repair or replace damaged culverts and downspouts. Provide energy dissipaters at culvert outlets or drainage dips.
23. Locate culverts or drainage dips in such a manner as to avoid discharge onto unstable terrain such as headwalls or slumps. Provide adequate spacing to avoid accumulation of water in ditches or road surfaces. Culverts should be placed on solid ground to avoid road failures.

24. Proper sized aggregate and riprap should be used during culvert construction. Place riprap at culvert entrance to streamline waterflow and reduce erosion.
25. Establish adapted vegetation on all cuts and fill immediately following road construction and maintenance.
26. Remove berms from the downslope side of roads, consistent with safety considerations.
27. Leave abandoned roads in a condition that provides adequate drainage without further maintenance. Close abandoned roads to traffic. Physically obstruct the road with gates, large berms, trenches, logs, stumps, or rock boulders as necessary to accomplish permanent closure.
28. Abandon and rehabilitate roads that are no longer needed. Leave these roads in a condition that provides adequate drainage. Remove culverts.
29. When plowing snow for winter use of roads, provide breaks in snow berms to allow for road drainage. Avoid plowing snow into streams. Plow snow only on existing roads.
30. Maintenance should be performed to conserve existing surface material, retain the original crowned or out-sloped self-draining cross section, prevent or remove rutting berms (except those designed for slope protection) and other irregularities that retard normal surface runoff. Avoid wasting loose ditch or surface material over the shoulder where it can cause stream sedimentation or weaken slump-prone areas. Avoid undercutting back slopes.
31. Do not disturb the toe of cut slopes while pulling ditches or grading roads. Avoid sidecasting road material into streams.
32. Grade roads only as necessary. Maintain drain dips, waterbars, road crown, in-sloping and outsloping, as appropriate, during road maintenance.
33. Maintain roads in special areas according to special area guidance. Generally, retain roads within existing disturbed areas and sidecast material away from the special area.
34. When landslides occur, save all soil and material usable for reclamation or stockpile for future reclamation needs. Avoid sidecasting of slide material where it can damage, overload, and saturate embankments, or flow into down-slope drainage courses. Reestablish vegetation as needed in areas where vegetation has been destroyed due to sidecasting.
35. Strip and stockpile topsoil ahead of construction of new roads, if feasible. Reapply soil to cut and fill slopes prior to revegetation.

2.6 Best Management Practices for Livestock Grazing

The purpose of this section is not to attempt to select certain practices and require that only those be used. It is not possible to evaluate all the known practices and make determinations as to which are best. What is best must be determined as a result of a site-specific investigation of the proposed management action. No one management practice is best suited to every site or situation. BMPs must be adaptive and monitored regularly to evaluate effectiveness.

The following sources contain information regarding grazing BMPs. Over time, other sources of information will become available and will be considered in proposed management actions.

The National Range and Pasture Handbook
http://www.glti.nrcs.usda.gov/technical/publications/nrph.html

Best Management Practices for Grazing
http://deq.state.wy.us/wqd/watershed/Downloads/NPS%20Program/92602.pdf

The following BMPs for livestock grazing management within greater sage-grouse Priority Habitat Management Areas have been identified from Cagney et al. (2010):

Sage-Grouse Habitat Season

- Mating Leks: Avoid any new sources of disturbance such as range improvements on lek sites.
- Nesting/Early Brood-Rearing: Maintain the Sagebrush/Bunchgrass Plant Community wherever currently present. Manage for high vigor in all plant communities. Avoid repeatedly using cool-season bunchgrasses in the critical growing season and limit utilization to moderate levels to assure that the previous year's standing crop is available for hiding cover.
- Late Brood-Rearing: Avoid repeatedly grazing riparian areas in seasons when temperatures are high.
- Winter: Avoid levels of browsing on sagebrush that would limit sage-grouse access to their food supply and cover. Additionally, avoid heavy use of herbaceous standing crop as this will adversely affect hiding cover the following spring.

Vegetation Community

- Bunchgrass: Consider changes in management that would increase utilization or change the timing of grazing on these sites.
- Sagebrush/Bunchgrass:
  - Retain sufficient residual cover to provide Sage-Grouse hiding cover the following year.
  - Employ planned grazing; periodic small-scale disturbance such as occasional thinning or specialized small ruminant grazing of dense (30+ percent canopy cover) sagebrush will help maintain this desired state.
- Sagebrush/Rhizomatous Grass/Bluegrass:
  - Establish grazing strategies tailored to plant growth requirements of cool-season grasses.
  - Retain sufficient residual cover to provide Sage-Grouse hiding cover the following year.
  - Avoid confining animals on inadequate pasture or supplemental feeding to compensate for a lack of natural forage.
- Sagebrush/Bare Ground: Restrict grazing in conjunction with restoration efforts until the site is ready to sustain grazing.

2.7 Best Management Practices for Visual Resources

The following BMPs would be considered to reduce impacts to all visual resource management classes within the Planning Area:

- Burying of distribution power lines and flow lines in or adjacent to access roads;
- Repeating elements of form, line, color, and texture to blend facilities and access roads with the surrounding landscape;
- Painting all above-ground structures, production equipment, tanks, transformers, and insulators not subject to safety requirements to blend with the natural color of the landscape, using paint that is a non-reflective "standard environmental color" approved by the BLM visual resource management (VRM) specialist:
    - All new equipment brought onto the sites should be painted the same color(s);
    - Semi-gloss paints will stain and fade less than flat paints;
    - Typically, the background is a vegetated background, and seldom a solid background;
    - The selected color should be one or two shades darker than the background; and
    - Consider the predominant season of public use; however, never paint an object to match snow.
- Performing final reclamation recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography;
- Avoiding facility placement on steep slopes, ridge tops, and hilltops;
- Screening facilities from view;
- Following contours of the land to reduce unnecessary disturbance;
- Recontouring and revegetating disturbed areas to blend with the surrounding landscape;
- Reclaiming unnecessary access roads as soon as possible to the original contour;
- Using gravel of a similar color to adjacent dominant soil and vegetation colors for road surfacing;
- Use dust abatement to reduce fugitive dust, as well as minimize the light colors of the routes;
- Avoiding locating pads in areas visible from primary roads;
- Using subsurface or low-profile facilities to prevent protrusion above horizon line when viewed from any primary road;
- Co-locating wells when possible;
- Locating facilities far enough from the cut and fill slopes to facilitate recontouring for interim reclamation;
- Locating wells away from prominent features, such as rock outcrops;
- Completing an annual transportation plan for entire area before beginning construction, and making a layout that will minimize disturbance and visual impact;
- Designing and constructing all new roads to a safe and appropriate standard "no higher than necessary" to accommodate their intended use;
- Locating roads far enough off the back of ridgelines so they aren't visible from state, county, or BLM roads;
- Using remote monitoring to reduce traffic and road requirements;
- Removing unused equipment, trash, and junk immediately.

2.8 Best Management Practices for Water Resources

BMPs would be appropriate for consideration to mitigate potential water quality impacts when proposed oil and gas activities are within 500 feet of riparian areas and surface waters of the state, Source Water Protection Areas identified in Wellhead or Source Water Protection Plans approved by the local governing body, and "High" and "Moderately High" sensitivity aquifers (identified throughout the use of the Wyoming Groundwater Vulnerability Assessment Handbook (as updated over time). BMPs to mitigate impacts to water resources include, but are not limited to, the following:

- Those management approaches for oil and gas activities required by Source Water and Wellhead Protection Plans approved by the local governing body; or
- Use closed loop drilling systems;
- Do not use evaporation ponds in proximity to shallow aquifers;
- Do not use unlined ponds or pits overlying sensitive aquifers;
- Line surface impoundment ponds (evaporation ponds or drilling pits) with synthetic liners and subsequently decommission by removing all contaminants and liner and reclaiming the area;
- Identify water supply wells and implement appropriate protection measures for the affected aquifer(s), as necessary to prevent the introduction of contaminants into the well;
- Require a monitoring plan which includes collection of baseline and periodic water quality data from potentially affected water supply wells, identification of parameters to monitor, reporting results to BLM and well owners, reporting to Wyoming Department of Environmental Quality-Air Quality Division;
- Review the geology of shallow aquifers to determine well construction requirements, which may include cementing to surface and drilling with a fresh water mud system;
- Requirement surface casing and cement to a specific formation or depth to protect aquifers at depth that need protection:
    - Set surface casing below the lowermost underground sources of drinking water and set into a confining (e.g., shale) layer;
    - Set an intermediate string of casing and cement in the event of deep aquifers;
    - Require submittal of a well logging plan and document submittal of plan to ensure proper well construction to protect groundwater. If a lost circulation event occurs during the installation of surface casing, a cement bond log will be required to be run on the surface casing to determine if the cement is adequate and protective.
    - Review the geology of shallow aquifers in proximity to groundwater development activities to determine potential impacts to flow patterns supporting water elements such as fen, wetlands, springs, and seeps, and ponds.

2.9 Best Management Practices for Greater Sage-Grouse Protection

Knowledge of BMPs for greater sage-grouse protections is an evolving field. As research is done on impacts of various kinds of activities, or the absence thereof, on greater sage-grouse, additional protections will be identified. While some of these will be generic enough to be applied planning area-wide, others will require site-specific analysis to determine if they are appropriate for inclusion as a

mandatory COA. This BMP section of this appendix will be supplemented as technology and understanding of greater sage-grouse advance.

3.0 REFERENCES

Cagney, Jim, Bainter, E., B. Budd, T. Christiansen, V. Herren, M. Holloran, B. Rashford, M. Smith, J. Williams. 2010. Grazing Influence, Objective Development, and Management in Wyoming's Greater Sage-grouse Habitat. University of Wyoming Cooperative Extension Service. B-1203. 62pp.

Sage-Grouse NTT (National Technical Team). 2011. A Report on National Greater Sage-Grouse Conservation Measures. December.